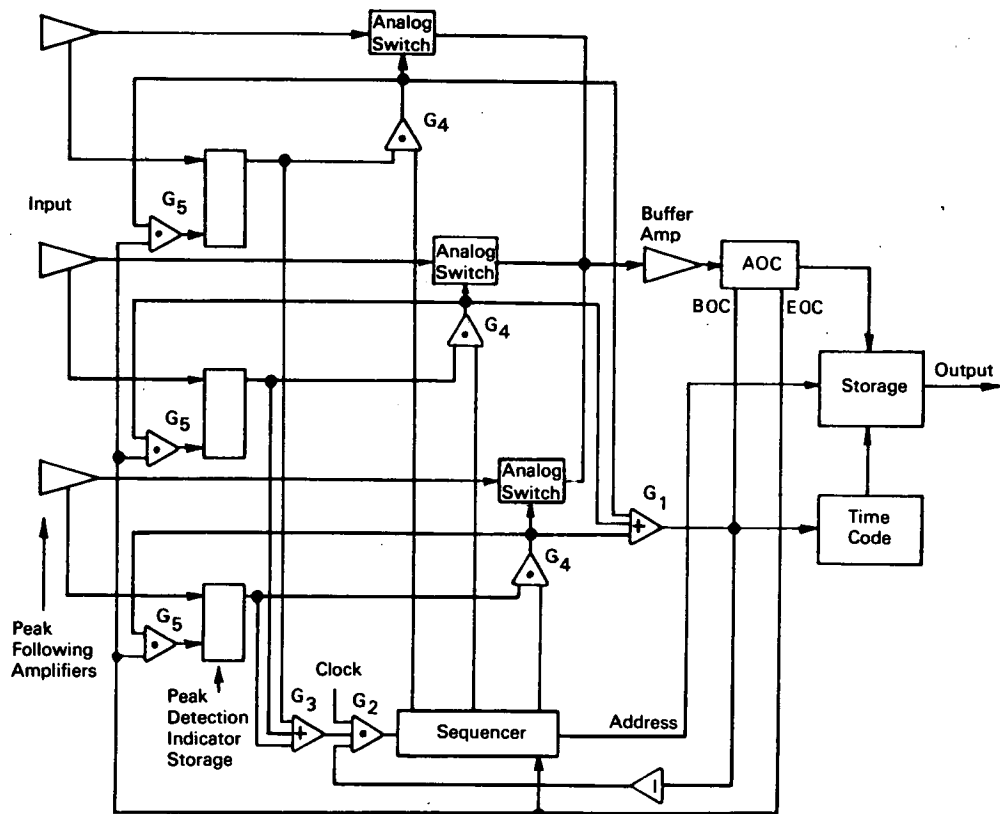


NASA TECH BRIEF



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Monitoring System Determines Amplitude and Time of Vibration Channel



The problem:

To devise a method for the continuous sampling and processing of several vibration channels in order to determine the amplitude and location in time of each peak of every channel. The channels contain vibration data of widely varied frequencies with the relative order of these frequencies generally known. Prior art sampled all channels at the same rate in a

continuous, fixed sequence mode. This method was in many instances too time consuming.

The solution:

Coordinate the higher frequency channels with the lower order addresses of a sequencing system and reset this to its initial condition upon completion of each conversion.

(continued overleaf)

How it's done:

The processing scheme includes an analog-type peak following amplifier for each channel, an analog commutator, a digital address control or sequencing device that is adaptive relative to the behavior of each channel, an analog-to-digital converter, and a time code generator common to all channels. An analysis of the timing involved in the worst case situation when (1) a peak occurs on a channel right after that particular channel was completed in the continuous mode and (2) when a peak occurs simultaneously on each channel, and all channels contain their outer limit frequencies in the adaptive mode, reveals the following:

The total time required to reach all channels in a continuous mode is n^2t and for the adaptive mode, where the address is returned to zero between samples and the inputs are assigned addresses inverse to the assumed frequencies, the total time is $(1+2+3+4+5+6+\dots+n)t$. The relationship between the two modes is then n^2t/n to $n+1/2(t)$ where n is the number of channels and t is the system clock period.

The outputs from the preprocessing analog amplifiers of which there are one per channel, are sampled

and converted to digital numbers for storage, recording and/or further processing. The sampling system is adaptive in a manner such that all peaks on all channels are processed. The bandwidths of the various channels with the relative orders of their frequencies generally known are then located in this order.

Notes:

1. This method is applicable to environmental testing and to space- or aircraft-borne vibration monitoring devices requiring a large number of channels. It is conceivable that this system could be used in aircraft development and in commercial aircraft as a monitoring system for determining safe operating limits.
2. Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, California 91103
Reference: B66-10699

Patent status:

No patent action is contemplated by NASA.

Source: Tage O. Anderson
(JPL-879)